



Marshall@the Millennium

Dawn of a new era in space transportation

by Deana Nunley

The leaders of NASA's advanced space transportation activity have a vision for the opening century of the third millennium: human settlements on other planets within 100 years.

"If you look at where we were as a civilization 1,000 years ago, or just 100 years ago," said Garry Lyles, manager of Marshall's Advanced Space Transportation Program, "it's quite realistic to expect human settlements in space in the 21st century."

As with any pioneering adventure, trailblazers must clear the way to the frontier. In the case of the Final Frontier, it requires building a highway to space.

"Safe, reliable, affordable transportation has been the key to exploration and development of frontiers that emerged throughout history," said Dr. Row Rogacki, director of the Space Transportation Directorate at Marshall. "And transportation is again the driver as we boldly prepare to explore and develop the largest frontier of all — the space frontier."

Ocean-going vessels enabled discovery of the New World and initiated global commerce. The stagecoach transported early settlers and cargo across the untamed American West, and the transcontinental railway opened up this new frontier to vast numbers of settlers and commerce.

Modern airways are a critical element of

international travel today. And with the dawn of the new century, space transportation can expand our global economy to a universal economy.

"Once we bring the cost and safety of space transportation in line with today's airlines, I believe we'll have a growth of people doing business in space," said Lyles. "The opportunities for scientific research and new space industries are limitless." Possibilities he lists include:

- Manufacturing medicines that are far superior to drugs made on Earth
- Prospecting asteroids and mining resources from orbiting bodies

See Space Transportation on page 3

Mars Polar Lander to set down Friday on smooth, layered terrain

NASA's Mars Polar Lander is due to set down under rocket power on layered, icy terrain near the south pole of Mars on Friday, with the first signal received on Earth that confirms the landing expected at 2:37 p.m. CST.

The two Deep Space 2 microprobes that are piggybacking on the lander will impact the planet's surface at about this same time. See related story on page 4.

The landing site is a swath of terrain measuring about 1,500 square miles (4,000 square kilometers).

"We looked for a site with slopes no steeper than 10 degrees," said Project Scientist Dr. Richard Zurek of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "We chose a location with some surface features but no cliffs or jagged peaks, because the spacecraft will be able to land safely, yet we'll still accomplish our science goals."

The landing site is located at 76 degrees south latitude and 195 degrees west longitude, near the northern edge of the south pole's layered terrain.

"We believe this layered terrain is a record of climate changes on Mars, and in a sense, digging into its surface will be

See Mars on page 4

Next Space Shuttle mission on track for Dec. 9 launch

Space Shuttle Discovery is being prepared for launch Dec. 9. The STS-103 mission is the third servicing mission to NASA's Hubble Space Telescope.

On Nov. 24, Shuttle technicians closed Discovery's payload bay doors and completed planned main engine testing. On Wednesday, Shuttle managers were to conduct a follow-up flight readiness review to obtain a final status on prelaunch preparations. The launch countdown is scheduled to begin Dec. 6 at 5:30 a.m. EST.

Mission Highlights:

- SHUTTLE ORBITER: Discovery
- LOCATION: Pad 39B, Kennedy Space Center, Fla.
- TARGET LAUNCH DATE/TIME: Dec. 9 at 1:10 a.m. EST

• TARGET LANDING DATE/TIME: Dec. 18 at approximately 10:15 p.m. EST

Complete information about the mission is available on the Web at:

<http://www.shuttlepresskit.com>

"Make SPACE for SAFETY"

— Safety slogan submitted by
Mary Ann Jefferson, SCSC

Missouri's first NASA Educator Resource Center opens

by Sherrie Super

Missouri's first NASA Educator Resource Center opened recently to give Missourians as well as neighboring states access to NASA expertise and educational materials in science, math and technology.

The new center is located at Southeast Missouri State University in Cape Girardeau. The Marshall Center selected the university through a competitive application process that ended with a two-year renewable agreement between NASA and the university.

The new center is part of the Marshall Center's efforts to expand its longstanding partnership with the education community. The agency's Educator Resource Center network provides access to NASA materials such as lesson plans, videotapes, compact discs, audio cassettes, reference books, activities, posters and lithographs.

All educators — from public and private school teachers to parents who home-school their children — may use these resources. For those unable to visit the center in person, the Internet and Web-based technology will be a complementary means of making information available to educators and students throughout Missouri and neighboring states.

Each Educator Resource Center is sponsored by a NASA facility, under a regional system. Marshall's Education Programs Department is responsible for centers in six states: Alabama, Arkansas, Iowa, Louisiana, Missouri and Tennessee.

The facility at Southeast Missouri State University will operate under the Linda M. Godwin Center for Science and Mathematics Education. Godwin, an astronaut, is the deputy chief of the astronaut office at NASA's Johnson Space Center in Houston, Texas. She has a bachelor's degree from Southeast Missouri and master's and doctorate degrees from the University



Courtesy photo

Southeast Missouri State University students Sean Watkins, left, from the Godwin Center, and Jessica Dinkins from the Math Resource Center were on hand for the grand opening of a new Educator Resource Center.

of Missouri in Columbia.

Selected by NASA as an astronaut candidate in 1985, Godwin became an astronaut in 1986. A veteran of three space flights, she has logged more than 633 hours in space, including a six-hour spacewalk. She was a mission specialist on the STS-37 flight in 1991, the payload commander on STS-59 in 1995, and a crew member on STS-76, a docking mission with Russian space station Mir, in 1996.

Godwin is the recipient of the NASA Outstanding Performance Rating, Sustained Superior Performance Award and Outstanding Leadership Award.

The writer, a contractor employed by ASRI, supports the Media Relations Department.

Marshall plans Christmas tree lighting, annual holiday reception for Dec. 15

Marshall's Christmas tree lighting and annual holiday reception will be Dec. 15.

The tree lighting will be at 9 a.m. on the front lawn of Bldg. 4200, followed by the reception from 9:30 a.m.-12:30 p.m. in Bldg. 4752.

The entertainment program includes performances by Marshall's Child Development Center, Sharon Hancock, Luis Trevino's Christmas Trumpet Carols, and a Barber Shop Quartet.

A food/toy drive will be conducted during the time leading up to the reception. Donations will earn raffle tickets for prizes from the NASA Exchange. Three

cans of food earns one ticket; a new toy earns three tickets.

Collection times for the food/toy drive will be 11 a.m.-1 p.m. Tuesdays and Thursdays at the Bldgs. 4203 and 4610 cafeterias, and in front of Charlie's Grill in Bldg. 4200 until Dec. 14. There will be a table at the reception for last-minute donations.

Collected food items will be donated to the No. Alabama Food Bank and collected toys will be donated to Christmas Charities Year Round. Center employees, retirees and contractors are invited to participate in the festivities. Shuttle services will be provided.

Job Opportunities

CPP 00-08-CV, Computer Specialist (System Analyst), GS-334-9 (potential to GS-12), Customer & Employee Relations Directorate, Plans and Systems Analysis Office. Closes Dec. 7.
CPP 00-17-JB, Executive Support Assistant (OA), GS-303-8, Center Operations Directorate. Closes Dec. 8.
CPP 00-14-KP, AST, Structural Dynamics, GS-861-14, Engineering Directorate, Structures, Mechanics & Thermal Department, Structural Dynamics & Loads Group. Closes Dec. 8.
CPP 00-21-JB, Industrial Property Management Specialist, GS-1103-5, Center Operations Directorate, Logistics Services Department, Property Management Group. Closes Dec. 14.
CPP 00-18-JB, AST, Environmental Engineering, GS-819-14, Center Operations Directorate, Environmental Engineering Department. Closes Dec. 8.

Gen. John Dailey to leave NASA in January

Gen. John R. Dailey, NASA's associate deputy administrator, will leave NASA to join the Smithsonian Institution as director of the National Air and Space Museum in January.

Dailey came to NASA in 1992 following retirement after 36 years of service in the U.S. Marine Corps, most recently as assistant commandant. For the past seven years, Dailey has served as the NASA Administrator's most senior adviser and led NASA's reinvention activities.

"The leadership provided by Jack Dailey has been unparalleled," said NASA Administrator Dan Goldin. "He has shaped and strengthened the Agency, and was responsible for developing an infrastructure that will carry NASA into the new millennium. His commitment to aviation and space is unmatched."



Photo by Dennis Olive, NASA/Marshall Space Flight Center

Great work, team

Row Rogacki, right, director of Marshall's Space Transportation Directorate, receives a plaque from Center Director Art Stephenson, left, on behalf of the RD 180 Atlas Fire Team at Marshall.

Space Transportation

Continued from page 1

- Generating cheap, clean power from the Sun
- Exploring new worlds and routinely transporting passengers

"NASA's role is to develop innovative technologies so our industry partners can develop commercially viable space launch vehicles that meet NASA's needs," said Rogacki.

The X-33, X-34 and X-37 technology demonstrators scheduled to fly in the early years of the 21st century are designed to reduce space transportation costs from today's price tag of \$10,000 per pound to \$1,000 per pound before 2010. Marshall's Advanced Space Transportation Program is pushing technologies to reduce that cost to only hundreds of dollars per pound by 2025 and a bargain price of tens of dollars per pound midway through the new century.

At the same time costs are decreasing, safety and reliability will be increasing to a level that will surpass today's airline transportation. In fact, spacecraft of the future will be equipped with intelligent vehicle health management systems that allow a launch vehicle to determine its own health without human inspection.

One radical technology being developed at Marshall and other NASA Centers is a rocket engine that breathes oxygen from the air during the climb to orbit. A magnetic levitation track that uses magnets and electricity to accelerate a vehicle at speeds up to 600 mph could give a launch vehicle a running start

before it leaves the planet. Propulsion systems that boost spacecraft with laser beams and propellant-free electrodynamic tethers could also become operational within the first half of the 21st century. An attractive feature of these advanced propulsion technologies is that the energy to propel the vehicle doesn't have to be carried on board, resulting in significant weight and cost reductions and better performance.

Marshall scientists and engineers are conducting fundamental research into exotic, high-energy propulsion required for travel to the outer planets and other star systems. Sails propelled through space by sunlight — just as wind pushes sailboats on Earth — could be used for an interstellar precursor mission as soon as 2010.

Marshall also is experimenting with antimatter, fusion and fission as propulsion alternatives for deep space travel in the third millennium. And NASA also is involved in basic research on the leading edge of modern science and engineering, such as space and time warping, gravity manipulation and theories that might enable faster-than-light travel.

Through intense technology development that will make space transportation safe and affordable for ordinary people, NASA is building a highway to space for the 21st century and unlocking the door to the Final Frontier.

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Mars penetrator probes named for pioneering polar explorers

NASA's Deep Space 2 microprobes, due to smash into the surface of Mars near the planet's south pole Friday, are named Amundsen and Scott in honor of the first explorers to reach the South Pole of Earth.

Paul Withers, a graduate student at the University of Arizona in Tucson, wrote the winning essay, among a NASA-record 17,000 entries submitted in a public contest to name the ambitious space mission.

Norwegian Roald Amundsen explored the Northwest Passage before leading the first successful expedition to the South Pole, reaching it on Dec. 14, 1911. Robert Falcon Scott led an English team to the South Pole in January 1912, only to discover the national flag left during Amundsen's earlier arrival. Although blizzards and starvation claimed Scott and his entire team on their return trip, the search party found scientifically valuable diaries and notebooks.

The main purpose of NASA's miniaturized probes is technical, not scientific: flight-testing advanced technology that could be used by future planetary surface microlanders. Constructed to survive an



Mars Polar Lander

abrupt impact at 400 mph with the layered terrain common in the south polar region of Mars, the two Deep Space 2 probes also carry sensors to search for the presence of water ice about 3 feet below the surface, as a secondary goal.

"Deep Space 2 joins Mars Polar Lander as the first missions to venture to the south pole of Mars, so it's only fitting to name the microprobes after the two explorers who first set foot on Earth's South Pole," said Deep Space 2 project manager Sarah Gavit. "Like Amundsen and Scott, Deep Space 2 will have to survive great odds, including not only braving the elements

but also crashing into the terrain with unbelievable force."

The Deep Space 2 probes are piggybacking on NASA's Mars Polar Lander spacecraft, which was launched on Jan. 3. Each probe has an entry system consisting of a basketball-sized aeroshell with a grapefruit-sized probe inside. Released from the cruise stage of the Mars Polar Lander on Friday before it enters the atmosphere of Mars, the probes will dive toward the surface with no braking system beyond their cone-shaped exterior surface. Unlike any spacecraft before them, the probes must endure impact forces up to 60,000 times the force of Earth's gravity as they hit the surface.

Upon impact, the aeroshell will shatter and the forebody of each probe will bury itself up to about 3 feet (1 meter) underground, while the aftbody remains on the surface to transmit data back to Earth through NASA's Mars Global Surveyor spacecraft.

If successful, Deep Space 2 will demonstrate innovative approaches to entering a planet's atmosphere, surviving a crash-like impact and penetrating below a planet's surface.

Mars

Continued from page 1

like reading tree rings or layers in an ice core," Zurek said.

"The presence of fine layers of dust and ice with varying thickness will indicate changes in weather patterns and layer formation that have been repeated in recent history. In addition, we may find evidence of soil particles that formed in ancient seas on Mars and were later blown into the polar regions.

The landing will be targeted to the center of the site, a rectangular area 124 miles (200 kilometers) long and 12.4 miles (20 kilometers) wide. The site was selected after the project team studied pictures and altimeter information gathered by NASA's Mars Global Surveyor, which is currently orbiting the planet. The search was narrowed to four sites before the final location was chosen. A backup landing site is located nearby, at 75 degrees south latitude and 180 degrees west longitude.

The Friday landing occurs toward the end of spring in the Martian Southern Hemisphere. The Sun will shine all day, moving higher and lower in the sky but never dipping below the horizon.

This nonstop sunshine will power the lander's solar panels for

90 days, until the Martian seasons change and the lander's mission ends.

Launched on Jan. 3, 1999, Mars Polar Lander will study the soil and look for ice beneath the surface of the Martian south pole. The lander also carries two Deep Space Two Microprobes that will be deployed about five minutes before the spacecraft enters the Martian atmosphere. When they land, they'll penetrate beneath the soil surface to look for water ice at nearby locations. The microprobes were developed under NASA's New Millennium Program.

Images of the landing site and additional information about Mars Polar Lander are available at the following Web site:

<http://mars.jpl.nasa.gov/msp98/lander/>

Additional information about Deep Space Two is available at the following Web site:

<http://nmp.jpl.nasa.gov/ds2/>

The Laboratory manages Mars Polar Lander and the New Millennium Program for NASA's Office of Space Science in Washington, D.C. The Laboratory is a division of the California Institute of Technology, Pasadena, Calif.



OSHA Voluntary Protection Plan

Marshall establishes worksite analysis team

by Kristie French

Each day, Marshall employees may face dangerous or hazardous situations in their jobs.

How these hazards are identified, documented and controlled can make the difference in whether you go home safe at the end of the day or are involved in a major mishap.

Many people and processes are in place at Marshall to work toward the safe outcome of all operations here. Each individual and his or her supervisor must assure that all operations and activities performed have been analyzed, hazards identified and controls put in place before activities occur.

In preparation for the Occupational Safety and Health Administration (OSHA) Voluntary Protection Program (VPP) review, Marshall has established the Safety Worksite Analysis Team (SWAT). The team will assist employees, supervisors and directorates in reviewing their existing processes of hazard assessment and documentation, identifying gaps and providing an effective and efficient method to cover those gaps.

Presently, several processes exist at Marshall for identifying hazards. Test Readiness Reviews, Operational Readiness Reviews and Formal Hazards Analyses are performed prior to major operations or activities.

Individual directorates perform Personnel Protective Equipment surveys and develop Chemical Hygiene Plans specific to their operations. Marshall's SWATeam will assist each directorate in gathering existing documentation for presentation as a Worksite Analysis story during the OSHA visit.

Each supervisor should evaluate with employees the tasks each employee performs to ensure the existing analyses cover all the hazards. For routine tasks which are not yet covered, a Job Hazard Analysis (JHA), formally called a Job Safety Evaluation, must be performed.

The SWATeam is working on templates and sample JHAs to provide as guidelines and will act as JHA experts to implement this as quickly as possible.

Benefits of the JHA include identification of misunderstandings, or "standard practice" discrepancies which may have evolved, and if left in place could make the job less safe; broadening the sets of eyes that look at routine processes which can shed a new light on the processes or causes of hazards; identifica-

tion of common causes; and evaluating the impact of the corrections for one process on other parts of the directorate.

Involving the workers in the analysis provides the best insight; they already may be implementing controls that have not been written. New employees without the "insight" could have an accident. JHAs also can help supervisors develop specialized training plans for employees.

The SWATeam also will emphasize the precedence of hazard reduction controls: first, try to eliminate the hazard; second, design for minimum hazards, incorporating safety devices; third, provide caution and warning devices, and develop administrative procedures and training. The precedence helps provide the safest possible operation, facility or activity.

All employees are included in the worksite analysis scope. One of the first JHA templates to be available will be for Marshall office workers. All employees and supervisors are encouraged to review the JHA template to assure they are providing the safest worksite possible. Additional JHA templates to be provided will include machinists, lab workers and test engineers.

The SWATeam hopes that each directorate will share comments on innovative controls for common hazards.

To volunteer for the SWATeam, call Kristie French at 544-7474 or Linda Myska at 461-4329. For more information, visit the Web site at:

<http://vpp.msfc.nasa.gov:2000/>

The writer is Marshall's VPP project manager.

Countdown to Y2K 29 Days Left

No problems are expected with Huntsville Utilities or TVA. For more information on what they have done to be compliant, see their Web pages at:

www.hsvutil.org/news/year2000.shtml

and:

www.tva.gov

Courtesy of Information Services Department

Employee Ads

Miscellaneous

- ★ English setter puppies, Bozeann Mosley breeding, parents are proven hunters. 230-0762
- ★ Little Mountain Marina membership; boating, camping, fishing, swimming, etc., \$4,000. 536-3435
- ★ Bemco queen mattress and springs, \$40 set. 837-6776
- ★ Yamaha DX-11 keyboard, \$250. 858-0272/843-1929
- ★ Oak and hickory firewood, cut to any length, will deliver. 931-433-6642
- ★ Children's clothes; boy's: infant through 3 years; girl's: infant through 4 years. 721-9749
- ★ Ashley wood-burning fireplace insert w/blower, approximately 10 years old, \$75. 885-2448
- ★ Retired beanie babies, \$7 each; antique desk and stool, \$75. 971-0048
- ★ Computer systems, 100 MHz Pentium, 14" monitor, \$200 obo; Apple 6100 DOS, twin monitors, extras, \$450. 828-6213
- ★ Sailboat, Classic Morgan 22, 1970, disp 3500#, draft 22", long cockpit, 16HP, sleeps 4, \$2,400. 881-4177
- ★ 1980 Airstream travel trailer, 31', rear bath. 536-3463
- ★ Red battery-powered Corvette, \$75; Harley-Davidson battery-powered motorcycle, \$75; Little Tyke tree house, \$60. 830-0966
- ★ AKC toy poodles, two males, \$275 each. 753-2278
- ★ Early American couch, three cushions, multi-color, 88"x36", two gold lamps. 837-7999
- ★ Large wooden desk, \$100; computer desk, \$40; queen floral quilt, \$60; manual treadmill, \$30; car cell phone, \$30. 534-0939
- ★ Set of four Tell City ladder-back chairs w/new rush seats, \$400. 586-2852
- ★ Fisher Price Tournament Table 3 in 1 (table tennis, hockey, pool), ages 6 and up, \$30. 539-6945
- ★ Sony Playstation w/two controllers, demo disk, and 12 games, \$250. 882-2323
- ★ Play Laundry Center, includes folding ironing board, washer and dryer, play iron, \$35. 233-1248
- ★ Entertainment center, corner, solid oak, \$650; matching bookcase, 7' tall, \$225. 881-5093
- ★ Web TV and wireless keyboard, \$225. 355-6116

Vehicles

- ★ 1992 GEO Storm, 38K miles, automatic, \$2,000 obo. 355-6116
- ★ 1986 Ford F150, V-8, automatic, LWB, \$1,750. 233-0766/508-8209
- ★ 1995 Mitsubishi 3000 GT, pearl white w/gray leather, 85K miles, \$12,500 obo. 830-8422
- ★ 1994 Ford Ranger XLT extended cab, 3.0L V-6, auto, air, PS/PB, bed liner, tinted windows, 38K miles, \$9,000. 881-0551
- ★ 1995 Chevy Cheyenne, sport side, 305 V-8, 5-speed, 75K miles, chrome-package, one-owner, \$12,000. 931-565-4332
- ★ 1988 Maxima, silver, one-owner, 127K miles, maintenance records, \$4,000. 883-2237
- ★ 1996 Mazda 626 LX, V-6, 56K miles, white, spoiler, moon roof, \$11,000. 574-5098 after 5:30 p.m.

Wanted

- ★ Sony stereo receiver, STR-6800 SD (or similar) for parts, must be cheap. 534-4968
- ★ Maytag washer for parts. 881-6040
- ★ Telescope, Schmitt Casegrain or Maksutov preferred. 464-9384/John after 5 p.m.
- ★ Golf clubs, set of Callaway or King Cobra metal woods; 1, 3, 5, 7, 9. 883-2948

Center Announcements

- ☛ **Rick Bachtel Retirement Reception** — A retirement reception honoring Rick Bachtel, former deputy director of the Space Transportation Directorate, will be held from 4-6 p.m. Dec. 9 in the Bldg. 4203 cafeteria. Tickets, at \$7.50 each, can be purchased from administrative officers.
- ☛ **Information Technology Training** — A three-day course, Risk Management and Security Policy Development, will be held Dec. 7-9, location to be determined. The training addresses the often complex world of information technology security policy, plans and risk management procedures. For information, call Chris Robinson at 544-1422.
- ☛ **NASA Exchange Nut Sale** — The NASA Exchange annual nut sale continues from 9 a.m.-4 p.m., Monday-Friday (excluding holidays) in the Marshall Activities Bldg. 4752 Racquetball Court No. 2 on a first-come/first-serve basis. Prices are: pecans 16 oz., \$5.50; natural almonds 12 oz., \$2.50; salted (in shell) natural pistachios 16 oz., \$3.60; English walnuts 16 oz., \$3.25;

cashews 16 oz., \$5.50; raw peanuts 16 oz., \$2; chocolate-covered pecans 16 oz., \$7; hickory smoked almonds 12 oz., \$3; and honey roasted almonds 12 oz., \$3.

- ☛ **MARS Ballroom Dance Club Christmas Dinner Dance** — The MARS Ballroom Dance Club will hold its Christmas Dinner Dance Dec. 11 in the Von Braun Center East Hall. The semi-formal event starts at 6:30 p.m. Tickets, at \$25 per person, with a \$5 discount for club members, can be purchased from Hugo Berry at 544-3525, Tamara Landers at 544-6818, Pat Sage at 544-5427, Ed Ogozalek at 837-1486, Linda Kinney at 544-0563, or Bob Williams at 544-3998. Reservations for a table of eight can be made by calling Woody Bombara at 650-0200.
- ☛ **AFGE Centerwide Open House** — All Marshall employees are invited to the AFGE Local 3434 Centerwide Open House from 11:30 a.m.-12:30 p.m. Dec. 14 at the Union Hall, Bldg. 4200, room G35.
- ☛ **NASA Exchange Book Fair** — The semi-annual book fair, sponsored by the NASA Exchange, will be held from 8 a.m.-4 p.m. Dec. 7-9 in Bldg. 4203, room 1201. A selection of best sellers, cookbooks, decorating, sports and children's books will be available for purchase at substantial savings. There will be daily drawings at 11 a.m. and 2 p.m. to win a free book of your choice. For more information, call Michele Miller at the NASA Exchange at 544-7564.
- ☛ **MARS Tennis Club Party** — The MARS Tennis Club end-of-season meeting and party will be held at 4:45 p.m. Thursday in Bldg 4203, room 1201. All club members are invited. New officers and rules changes will be announced, league, group tournament and sportsmanship trophies awarded, and the 1999 budget report.
- ☛ **Photo Lab Retirees Meet** — Photo lab retirees will meet at 9:30 a.m. Dec. 7 at Shoney's at University Drive and Memorial Parkway. For more information, call Charles Allen at 852-0917.
- ☛ **MARS Fishing Club** — The next tournament is the Sauger Tournament on Dec. 11 on Wheeler Lake out of Ditto Landing. The club encourages participation by NASA employees, family members and on-site contractors. For more information, call Charles Kilgore at 544-9437; Don McQueen at 544-9073 or Charlie Nola at 544-6367.
- ☛ **Marshall Open House** — Marshall's Open House will be held from 9 a.m.-6 p.m. May 20, 2000. Admission is free. For more information, call Angela Storey at (256) 544-0632.

MARSHALL STAR

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